Result Page

Reactor for execution catalytic gas reactions with a plurality of cold gas supply

The invention relates to a reactor for execution catalytic gas reactions with a plurality of cold gas supply flowing arranged over the height of the reactor into the catalyst bed.

From the DE-AS 15 42 209 a such reactor is known, with which the cold gas supply exist out transverse to the direction of flow of the reaction gas arranged, mixing area formed cages with perforated walls, which preferably exhibit inside arranged tubes for the feed line of the Kaltgases, whereby for making the entry of a substantial portion of the reaction gas possible into the cages these corresponding large designed are. Adverse one with this known embodiment is to the one the not insignificant space requirement of the cages, whereby the reaction space filled with catalyst is unnecessary limited. On the other hand it has itself shown that no satisfactory mixture of the hot reaction gases with the supplied Kaltgasen takes place, which is called that itself a desired, as uniform steady a temperature profile over the height of the reactor as possible and an high reaction turnover degree resultant from it does not adjust.

In contrast to this the object of the invention exists in the provision of a solution, which with as small a space requirement as possible a satisfactory mixture of the supplied Kaltgase with the hot reaction gases possible, in order to adjust over the height of the reactor as uniform, steady a temperature profile as possible.

This object becomes according to invention with a reactor of the initially referred type by the fact dissolved that the cold gas supply are as vertical arranged, the catalyst bed only bereichsweise penetrating nozzle tubes formed, which with horizontal feed lines connected is.

It turned out that with the formation according to invention of the reactor with small space requirement a good mixture of supplied Kaltgasen and hot reaction gases is more achievable, whereby over the height of the reactor a relative uniform temperature profile with only small temperature gradients adjusts itself. The good mixture results essentially from the fact that the vertical nozzle tubes are parallel for the mainstream direction of the hot reaction gases arranged, so that the Kaltgase are drug along from the nozzle openings vertical for mainstream direction to withdraw and corresponding by the hot reaction gases and obligatorily to mix itself. As a result of the variety in a plane of next to each other arranged nozzle tubes in the case of it an almost uniform temperature distribution arises in each case over the respective reactor cross section.

As particularly favorable it turned out, if the nozzle tubes are suspended arranged at the feed lines. The Kaltgase withdraw then essentially downward directed, in the same direction as the main river of the hot reaction gases from the nozzle tubes, so that a particularly good mixture adjusts itself.

In advantageous embodiment of the invention is provided that the feed lines in each case a plane of one horizontal each, the reactor coat penetrating central tube and on both sides the same arranged, horizontal distribution pipes formed are. This formation is to be manufactured on the one hand constructive relative simple, on the other hand one ensured is by this formation that the space standing for the catalyst for the order is sufficient large.

The distribution pipes are favourably in a distance making a catalyst flow possible next to each other arranged at the central tube, whereby a proper filling of the reactor with catalyst and/or. Emptying possible is, since the fine-grained catalyst slips through.

The stability of the reactor installations can become by the fact elevated that the distribution pipes are provided with reinforcing ribs.

Finally the invention plans that the vertical nozzle tubes are provided with a perforated jacket, which can be favourable formed from expanded metal. Is by this jacket ensured that the nozzle openings of the nozzle tubes cannot add themselves and clog with catalyst, whereby on the other hand the Kaltgase still proper into the catalyst bed influxes can.

The invention is appended for example more near explained on the basis the drawing. This shows in:

Fig. 1 in simplified representation a longitudinal section by one invention in accordance with formed reactor,
Fig. 2 a cross section by a reactor,
Fig. 3 a section in accordance with line III - III in Fig. 2,
Fig. 4 an enlarged represented single nozzle tube in an elevation view and
Fig. 5 a section in accordance with the line V - V in Fig. 4.

A general with 1 referred reactor is in the drawing strong simplified only shown with its for the invention essential features. The reactor is suitable for a variety of catalytic gas reactions, in particular however for exothermic reactions, whereby whole a prefered use with the methanol synthesis bottom high printing and temperatures from approximately 200 to 300 <o> C provided is.

▲ top

The reactor 1 exhibits a cylindrical shell 2, an upper ball soil 3 with gas inlet connecting pieces 4 as well as a lower ball soil 5 with gas outlet nozzle 6. At least in the range of the cylindrical shell 2 the reactor 1 with a catalyst bed is 7 filled, which itself in addition, until into the range of the lower ball soil 5 can extend. To the filling of the reactor 1 with catalyst and/or. to the deflation are in the upper ball soil 3 and in the lower ball soil 5 corresponding, not represented openings provided.

Over the height of the reactor 1 in the range of the cylindrical shell 2 a plurality of cold gas supply is 8 arranged, which consist the

cylindrical shell of 2 penetrating horizontal feed lines 9 also arranged vertical nozzle tubes 10 suspended to it.

The formation of the cold gas supply 8 is in the Fig. 2 and 3 more near shown. The horizontal feed lines 9 a plane are reciprocal in each case from an horizontal, the reactor coat 2 penetrating central tube 11 with horizontal distribution pipes arranged to it 12 formed, whereby the length of the distribution pipes is 12 in such a manner formed increased to the reactor center that the entire reactor cross section with distribution pipes is 12 equipped. The distribution pipes 12 can preferably exhibit reinforcing ribs 13, which are corresponding with the central tube 11 connected.

The distribution pipes 12 are at the central tube 11 arranged in such a manner next to each other that the light distance between the single tubes is 12 sufficient large, in order to ensure a proper flow of the catalyst with fillings or deflation. As particularly favorable thereby a distance of approximately 80 mm turned out lights. This distance is of course in addition, from the particle size of the used catalyst dependent.

Like particularly good from Fig. 3, are the nozzle tubes 10 one behind the other in each case vertical suspended at the distribution pipes 12 arranged come out. The central tube 11 is prefered on a supporting ring 14 arranged formed in the inside of the cylindrical shell 2, whereby sonders a simple in and removal of a respective central tube are 11 with the distribution pipes 12 and nozzle tubes 10 possible.

The embodiment of the nozzle tubes 10 is in the Fig. 4 and 5 more near shown. The nozzle tubes 10 are 15 sealed at their front ends with a cover, so that introduced Kaltgas can withdraw only through in the lateral faces formed nozzle openings 16. The cover 15 is 10 formed, so that an annular support surface is 17 formed for a perforated jacket 18, thereby disk shaped with a larger outside diameter than the associated nozzle tube, in particular from expanded metal. This jacket 18 coated thereby the entire outside surface of the nozzle tube 10 and prevented that catalyst can arrive into the range of the nozzle openings 16 and clog these. The perforation is a so selected that the outgoing Kaltgas can leak out unimpaired.

As in Fig. 1 shown is, flows in the actual reaction gas by the gas inlet connecting piece 4 toward the arrow 19, that the main gas flow characterized. Simultaneous one becomes from the outside by the central tubes 11 Kaltgas supplied, which by arrows 20 indicated is. The reaction gas, by the reaction in the catalyst bed 7 heated, flows itself essentially in the main gas flow direction 19 from above downward by the catalyst bed 7, while the Kaltgas arrives by the central tubes 11 and the distribution pipes 12 into the nozzle tubes 10 and fine partitioned for main gas direction 19 vertical from the nozzle openings 16 into the catalyst bed withdraws. The Kaltgas becomes such a bottom pressure into the central tube 11 introduced that an uniform exit from all nozzle openings is 16 ensured.

In the catalyst bed 7 fine distribute yourself Kaltgas mixed with the hot reaction gases, which leads to a cooling of the reaction gases, whereby from the variety of the nozzle tubes 10 over the respective reactor cross section, next to each other arranged in a respective plane, an uniform temperature profile results. In addition rising of the reaction temperatures becomes to a large extent avoided by the plurality of cold gas supply 8 arranged over the height of the reactor 1, so that from the reactor entrance a relative uniform temperature profile with small temperature gradients adjusts itself 4 to the reactor withdrawal 6.

Natural one is not the invention on the embodiments limited represented in the drawing. Other aspects of the invention are possible, without leaving the principle. Like that it is also possible to arrange the nozzle tubes 10 upward directed. In addition the single central tubes 11 can be also to a common, the reactor coat penetrating cold gas inlet connected and such. more.

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Result Page

1. Reactor for execution catalytic gas reactions with a plurality of cold gas supply, thereby, flowing arranged over the height of the reactor, into the catalyst bed, characterized,
that the cold gas supply (8) are as vertical arranged, the catalyst bed (7) only bereichsweise penetrating nozzle tubes (10) formed, which with horizontal feed lines (9) connected are.

2. Reactor according to claim 1,
thus characterized,
that the nozzle tubes (10) are suspended arranged at the feed lines (9).

3. Reactor according to claim 1 or 2,
thus characterized,
that in each case the feed lines (9) are a plane of one horizontal each, the reactor coat (2) penetrating central tube (11) and on both sides the same arranged horizontal distribution pipes (12) formed.

4. Reactor according to claim 1 or one the subsequent,
thus characterized,
that the distribution pipes (12) are into a catalyst flow making possible distance arranged at the central tube (11) next to each other.

5. Reactor according to claim 1 or one the subsequent,
thus characterized,
that the distribution pipes (12) are provided with reinforcing ribs (13).

6. Reactor according to claim 1 or one the subsequent,
thus characterized,
that the vertical nozzle tubes (10) are provided with a perforated jacket (18).

7. Reactor according to claim 6,
thus characterized,
that the jacket (18) from expanded metal is formed.

▲ top